What is claimed is:

1. A method for performing 2:1 downscaling on video data, comprising the steps of:

forming at least one input matrix of NxN Discrete Cosine Transform (DCT) coefficients from the video data by combining four N/2xN/2 field-mode DCT blocks;

performing vertical downsampling and de-interlacing to the input matrix to obtain two N/2xN/2 frame-mode DCT blocks;

forming an NxN/2 input matrix from the two frame-mode DCT blocks; and

performing horizontal downsampling to the NxN/2 matrix to obtain one N/2xN/2 frame-mode DCT block.

2. The method of claim 1, wherein N=16.

3. The method of claim 1, wherein:

the vertical downsampling also achieves low pass filtering of the NxN input matrix.

4. The method of claim 1, wherein:

the vertical downsampling uses a sparse downsampling matrix.

5. The method of claim 4, wherein:

the sparse downsampling matrix=$0.5[I_8\ I_8]$, where I_8 is an 8x8 identity matrix.

6. The method of claim 1, wherein:

the horizontal downsampling uses a sparse downsampling matrix composed of odd "O" and even "E" matrices.

7. The method of claim 6, wherein:

the even matrix has the following form:

E = [e(0) 0 0 0,
0 e(1) 0 e(2),
0 0 0 0,
0 e(3) 0 e(4),
0 0 e(5) 0,
0 e(6) 0 e(7),
0 0 0 0,
0 e(8) 0 e(9)]

where e(1) through e(9) are non-zero coefficients; and

the odd matrix has the following form:

O = [0 0 0 0,
o(0) 0 o(1) 0,
0 o(2) 0 0,
o(3) 0 o(4) 0,
0 0 0 0,
o(5) 0 o(6) 0,
0 0 0 o(7),
o(8) 0 o(9) 0]

where o(1) through o(9) are non-zero coefficients.

8. An apparatus for performing 2:1 downscaling on video data, comprising:

means for forming at least one input matrix of NxN Discrete Cosine Transform (DCT) coefficients from the video data by combining four N/2xN/2 field-mode DCT blocks;

means for performing vertical downsampling and de-interlacing to the input matrix to obtain two N/2xN/2 frame-mode DCT blocks;

means for forming an NxN/2 input matrix from the two frame-mode DCT blocks; and

means for performing horizontal downsampling to the NxN/2 matrix to obtain one N/2xN/2 frame-mode DCT block.

9. The apparatus of claim 8, wherein N=16.

10. The apparatus of claim 8, wherein:

the means for performing vertical downsampling also achieves low pass filtering of the NxN input matrix.

11. The apparatus of claim 8, wherein:

the means for performing vertical downsampling uses a sparse downsampling matrix.

12. The apparatus of claim 11, wherein:

the sparse downsampling matrix=$0.5[I_8\ I_8]$, where I_8 is an 8x8 identity matrix.

13. The apparatus of claim 8, wherein:

the means for performing horizontal downsampling uses a sparse downsampling matrix composed of odd "O" and even "E" matrices.

14. The apparatus of claim 13, wherein:

the even matrix has the following form:

E = [e(0) 0 0 0,
0 e(1) 0 e(2),
0 0 0 0,
0 e(3) 0 e(4),
0 0 e(5) 0,
0 e(6) 0 e(7),
0 0 0 0,
0 e(8) 0 e(9)]

where e(1) through e(9) are non-zero coefficients; and

the odd matrix has the following form:

O = [0 0 0 0,
o(0) 0 o(1) 0,
0 o(2) 0 0,
o(3) 0 o(4) 0,
0 0 0 0,
o(5) 0 o(6) 0,
0 0 0 o(7),
o(8) 0 o(9) 0]

where o(1) through o(9) are non-zero coefficients.